

Notice of Allowability

Application No.

09/602,515

Examiner

Beth Van Doren

Applicant(s)

TESTA, LEONARD J.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 2/27/07.
2. ☒ The allowed claim(s) is/are 55.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
- * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

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DETAILED ACTION

1. The following statement of reasons for allowance is in response to the after-final communications 02/27/2007. Claim 55 was amended. Thus, claim 55 is currently pending and allowed. The current action includes an Examiner's amendment and Examiner's Reasons for Allowance.

Examiner's Amendment

2. An examiner's amendment to the record appears below. Should the changes be unacceptable to the applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mr. Edward Rilee on March 7, 2007. The application has been amended as follows:

In the claims:

55 **An Apparatus** [A method] for producing a schedule of a plurality of time dependent tasks comprising:

means for receiving and storing a plurality of tasks to be scheduled;

means for receiving and storing a maximum amount of time allowed to schedule the plurality of tasks:

means for generating only a portion of a number of schedule permutations required to produce an optimal schedule of the plurality of tasks using an enumerative brute force method;

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means for estimating an amount of time required to generate the number of schedule permutations required to produce the optimal schedule from the amount of time used to generate the portion of the number of schedule permutations;

means for determining whether the estimated amount of time is greater than the maximum amount of time allowed to generate the schedule;

means for producing the optimal schedule using the enumerative brute force method if the estimated amount of time required is not greater than the maximum amount of time allowed to schedule the plurality of tasks;

means for generating only a portion of a number of schedule permutations required to produce a schedule of tasks using a deterministic programming method if the optimal schedule is not yet produced;

means for estimating an amount of time required to generate the schedule of the plurality of tasks to be scheduled using the deterministic programming method based on the amount of time required to schedule the portion of the plurality of tasks using the deterministic programming method if the optimal schedule is not yet produced;

means for estimating an amount of memory space required to schedule the plurality of tasks using the deterministic programming method based on the amount of memory space required to schedule the portion of the plurality of tasks using the deterministic programming method if the optimal schedule is not yet produced;

means for determining whether the estimated amount of time required to generate the schedule is greater than the maximum amount of time allowed to schedule the plurality of tasks if the optimal schedule is not yet produced;

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means for determining whether the estimated amount of memory space required to generate the schedule is greater than a maximum amount of memory space if the optimal schedule is not yet produced;

means for generating the schedule of the plurality of tasks to be scheduled using the deterministic programming module if the estimated amount of time required to generate the schedule is not greater than the maximum amount of time allowed to generate the schedule and the estimated amount of memory space is not greater than the maximum amount of memory space and the optimal schedule is not yet produced; and

means for generating the schedule using a genetic method if the estimated amount of time required to generate the schedule is greater than the maximum amount of time allowed or the estimated amount of memory space is greater than the maximum amount of memory space and the optimal schedule is not yet produced.

Reasons for Allowance

3. Claim 55 is allowed.
4. The following is an examiner's statement of reasons for allowance: None of the prior art of record, taken individually or in any combination, teach, inter alia, **means for generating only a portion of a number of schedule permutations required to produce an optimal schedule of the plurality of tasks using an enumerative brute force method**, estimating an amount of time required to generate an optimal schedule by the brute force method, and then determining whether the estimated amount of time is greater than the maximum amount of time allowed to generate the schedule. Further, none of the prior art of record, taken individually or in any

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combination, teach, inter alia, means for **generating only a portion of a number** of schedule permutations required to produce a schedule **using a deterministic programming method** if the optimal schedule is not yet produced (by the brute force method), estimating the amount of time and memory space required to generate the schedule, and comparing this time and memory space to the maximum memory space and time allowed, and then **using a genetic method** to generate the schedule, if the optimal schedule is not yet produced (by the deterministic or brute force methods).

The prior art references most closely resembling the Applicant's claimed invention are Hillier et al. (*Introduction to Operations Research*), Syswerda (U.S. 5,319,781), Oba et al. (U.S. 5,241,465), Crowder, Jr., et al. (U.S. 6,606,529).

Hillier et al. discloses size, number of iterations, and efficiency considerations when choosing between enumeration, deterministic linear programming, and genetic type heuristics such as policy improvement algorithms. Hillier et al. specifically discusses on page 843 that exhaustive enumeration is quick and straightforward for smaller problems and Linear programming (deterministic) is good solve larger problems than enumeration, especially with the software applications available. Further, Hillier et al. states that heuristic algorithms like policy improvement algorithms are efficient because it reaches an optimal solution in a smaller number of iterations (far fewer than deterministic and enumeration). However, Hillier et al. does not specifically disclose generating only a portion of a number of schedule permutations required to produce an optimal schedule or estimating the amount of time and/or memory space required to generate the schedule.

Syswerda discloses evaluating schedules, grouping schedules by score, and deleting schedules at a certain threshold score to generate optimal schedules based on the constraints. Syswerda specifically discloses having a random ordered list of tasks, building schedules, and using a genetic procedure to generate an optimal schedule. However, Syswerda does not specifically teach generating only a portion of a number of schedule permutations required to produce an optimal schedule using an enumerative brute force method, estimating an amount of time required to generate an optimal schedule by the brute force method, and then determining whether the estimated amount of time is greater than the maximum amount of time allowed to generate the schedule. Further, Syswerda does not expressly disclose generating only a portion of a number of schedule permutations required to produce a schedule using a deterministic programming method if the optimal schedule is not yet produced (by the brute force method).

Oba et al. discloses using a computer-based system to determine an optimal schedule. Scheduling strategies are stored by the system, and where the schedules are determined through repetition by selecting and executing strategies from the database. As the schedules are changed, they are evaluated against previous schedules to determine the best schedule produced. However, Oba et al. does not expressly disclose generating only a portion of a number of schedule permutations required to produce an optimal schedule of the plurality of tasks using an enumerative brute force method, the brute force method, or genetic methods.

Crowder, Jr., et al. discloses multi-task scheduling in minimal time by partitioning a multi-task scheduling problem into a set of scheduling problems and then picking one of a plurality of algorithms to provide an optimal solution in minimal time. This includes mixed integer programming and genetic algorithms. Crowder, Jr., et al. further discusses a "brute

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force" computation, with weaknesses with respect to solving large-scale, computationally complex scheduling problems that have a large number of constrained resources that must be scheduled, time sensitive actions to be scheduled, and a large problem/solution space. Crowder, Jr., et al. further discusses deterministic methods. However, Crowder, Jr., et al. does not specifically teach first **generating only a portion of a number** of schedule permutations required to produce an optimal schedule of the plurality of tasks **using an enumerative brute force method**, estimating an amount of time required to generate an optimal schedule by the brute force method, and then determining whether the estimated amount of time is greater than the maximum amount of time allowed to generate the schedule (and if so, trying a deterministic method).

5. Any comments considered necessary by the Applicant must be submitted by no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statements for Reasons for Allowance".

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Paulley (U.S. 6,516,310) and Paulley (U.S. 2002/0116357) teaches enumeration algorithms including genetic algorithms and deterministic algorithms, to find a reasonable plan.

Joslin et al. (U.S. 6,272,483) discloses creating as many good schedules as possible, within a time limit, and discusses linear and genetic algorithms.

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Matheson et al. (U.S. 2004/0034556) teaches constraints on scheduling, such as time constraints.

Dietrich et al. (JP 07105288) discloses producing an optimal schedule using LP algorithms.

Kobti ("Implementation of Genetic Algorithms in optical wavelength ring routed network design") discloses determining an optimal solution, including using brute force algorithms and genetic algorithms within reasonable time constraints.

Herrmann et al. ("Design of Material Flow Networks in manufacturing facilities") teaches realistic sized problems in reasonable time limits, and performing optimal scheduling, and further discloses enumeration and linear schemes.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Beth Van Doren whose telephone number is (571) 272-6737.

The examiner can normally be reached on M-F, 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tariq Hafiz can be reached on (571) 272-6729. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

lwd
bvd

March 7, 2007

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Patent Examiner